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Student Notes
Science on Saturday
Lawrence Livermore National Laboratory

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Menacing Microbes: Protein Models Reveal Secrets

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Overview:

Microbes are living organisms too small to be seen. While most are friendly to humans, some microbes, called pathogens, can cause disease. Although the medical field has created miraculous antimicrobial drugs to ward them off, menacing microbes often change their protein make-up in devious ways to evade being destroyed, resulting in antibiotic resistance and eventually "super-bugs." Proteins are diverse and dynamic biomolecules that determine how organisms thrive in changing environments. Protein modeling is a computational tool that researchers use to see microbial proteins. Using LLNL's high performance computational capabilities, 3D models are created of microbial proteins, providing visual tools to expose microbial secrets. This information can be used to help detect, understand, and identify new ways to treat the menacing microbes.

Outline:

1. What do all microbes (tiny organisms) have in common? What do they also have in common with humans?

2. What are antibiotics and who is credited for discovering them?

3. How do some bacteria become antibiotic resistant?

4. What are proteins and where do they come from?

5. List the 5 types of amino acids in terms of how they interact with each other.

6. What is meant by 'folding' of proteins and how does it happen?

7. What is one way a protein shape be changed, and how might this affect its function?

8. Why are scientists interested in how microbes change their proteins?

9. Why do scientists need models to study protein shape?

10. Describe an example of how a protein model is used to learn a microbe's secret.

11. How can microbes (bacteria) change to evade medicine?

Beth Vitalis has been involved with bioinformatics and pathogen detection and characterization at LLNL for 13 years. She received her BA in Chemistry from Concordia College, MN and her PhD in Biomedical Sciences from UC San Francisco. She moved to Livermore in 1997 to coach cross-country at Las Positas College and soon started teaching Biology courses. In 1999, she began working as a Life Science Scholar in the Biosciences department at LLNL as a member of the bioinformatics team. Since 2002, she has been lead biologist on the LLNL Pathogen Bioinformatics team and has provided biological guidance of bioinformatics efforts supporting pathogen detection and characterization for numerous collaborations and sponsors, including the Centers for Disease Control (CDC). Since 2008, she has enjoyed being back as an adjunct faculty member at Las Positas College, teaching a variety of Human Biology courses.

Dean Reese has been teaching Physics at Tracy High School since 2002. He received his BA in Physics and Astronomy from the University of Massachusetts in 2002. Upon completion of his undergraduate degree, Dean decided to move across the country to California to try his hand at teaching and has been doing so ever since. In 2011, he received his MA in Science Education from WGU. He is very enthusiastic about his profession and enjoys making connections with local scientists. In the summer, Dean works as a Faculty Scholar in LLNL's Education Program. Prior to becoming a teacher, Dean was a soldier in the United States Army National Guard.